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APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
09 362,924	07 27 1999	WAICHING CHOW	1945.P2 USA	7451

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APPLIED MATERIALS, INC.
PATENT DEPARTMENT
P. O. BOX 450 A
SANTA CLARA, CA 95054

EXAMINER

OLSEN, ALLAN W

ART UNIT	PAPER NUMBER
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1746

13

DATE MAILED: 04 15 2002

Please find below and/or attached an Office communication concerning this application or proceeding.

MF-13

Office Action Summary

Application No. 09/362,924		Applicant(s) CHOW ET AL.	
Examiner Allan W. Olsen		Art Unit 1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 27 July 1999.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-7,9-27,29-36 and 39-54 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) 1,4-6,27,29-36,39,40 and 46 is/are allowed.
- 6) ☐ Claim(s) 7,9-15,17-26,41-44,47-49 and 51-54 is/are rejected.
- 7) ☒ Claim(s) 16,45 and 50 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Withdrawal of Claim Objections and Rejections

In view of the amendment and remarks filed December 17, 2001:

the objections to claims 6, 48 and 49 is withdrawn;

the rejection of claims 32-34 and 36 under 35 U.S.C. 112 is withdrawn;

the rejection of claims 1-6 under 35 U.S.C. 102(b) as being anticipated by Japanese Patent Publication 01050427 (Hiroyuki) is withdrawn;

the rejection of claims 10, 11, 35 and 36 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,180,464 (Tatsumi) is withdrawn;

the rejection of claims 35 and 36 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,354,417 (Cheung) is withdrawn;

the rejection of claims 7, 9-16, 18, 27, 29-33 and 46-50, under 35 U.S.C. 102(b) as being anticipated by EP 0 709 877 A1 (Saito) is withdrawn;

the rejection of claims 7, 9-12, 14 and 15, under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,164,330 (Davis) is withdrawn;

the rejection of claims 27 and 29-34 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,378,311 (Nagayama) is withdrawn;

the rejection of claims 7, 9-15, 17, 18, 35 and 36 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 5,874,363 (Hoh) is withdrawn;

the rejection of claims 41 and 42 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 5,817,534 (Ye) is withdrawn;

the rejection of claims 41-45 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,620,615 (Keller) in view of Ye is withdrawn;

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Claim Objections

Claim 1 is objected to because of the following informality: the first two steps are both referred to as step (a). Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 9 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 9 recites the limitation "A method according to claim 8". There is insufficient antecedent basis for this limitation because claim 8 has been canceled.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

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Claims 7, 9, 12-15, 17-26, 51, 53 and 54 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,180,464 (Tatsumi).

Tatsumi describes a process of etching a multi-layered substrate comprising patterned mask which overlies a metal silicide layer which in turn is overlying a polysilicon layer which overlies an oxide layer which overlies a silicon base. Tatsumi teaches etching the polycide layer (i.e. the combined tungsten silicide and polysilicon layers) with HBr mixed with NF_3 or SF_6 in a 1:1 to 1:99 ratio. To this mixture He and/or O_2 may be added. Tatsumi teaches conducting an oxygen plasma treatment before the last over-etching step which consist of using a plasma of either 100% SF_6 or 100% HBr. The overetch is carried out with a chamber pressure of 5 mTorr and a source power to bias power ratio of 8.5:1. See columns 7 and 8.

Applicant and Tatsumi etch the same material (polycide). The gases used by Tatsumi correspond to the claimed etching and cleaning gases. However, Tatsumi and applicant do not attach the same label or function to each particular gas. For example, both applicant and Tatsumi use SF_6 to etch a W/Si layer. Applicant claims SF_6 as a cleaning gas while Tatsumi makes no reference to a cleaning gas. Despite the fact that Tatsumi does not refer to SF_6 as a cleaning gas it is the examiner's position that the same gas being used in like processes would inherently function in the same capacity.

Claims 7, 9-15, 19-26, 47-49 and 51 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,354,417 (Cheung).

Cheung teaches a multi-step plasma etching method. In a first step, a mixture of HBr, SF_6 , and O_2 is used. In a second step, a mixture of HBr, Cl_2 , He and O_2 is used. Cheung teaches that etching processes results in etching residue being deposited upon

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the surface of the chamber walls. However, with Cheung's method the amount of residue is reduced because the process gases remove the residue. Following the second step an oxygen plasma step is performed after which the substrate is removed from the chamber to undergo a wet etch/cleaning step.

There is not absolute correlation between the terminology in applicant's claims and in Cheung's disclosure. For example, Cheung does not describe the cleaning aspect of the oxygen plasma step. However, the examiner sees this step as being analogous to applicant's final cleaning step of the process set forth in Table 2 on page 22 of the specification. Even though Cheung does not attribute the cleaning function to the oxygen plasma step it is the examiner's position that the same gas being used in equivalent processes would inherently function in the same capacity. A comparison between applicant's enabling disclosure (Table 2 and related discussion) and the process of Cheung as set forth in example 14, column 8 and table III, shows that, within the context of the rejected claims, the two methods are the same. See: abstract; column 1, line 65 – column 2, line 23; Column 2, lines 59-64column 4, lines 1-10, 42-54; column 6, lines 1-32; column 8, line 12- column 9, line 27.

Claims 41-44 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 5,865,896, issued to Nowak et al. (hereinafter, Nowak).

Nowak teaches a method of cleaning a chamber by applying variable RF power to an antenna and forming an oxygen containing inductively coupled plasma. Nowak teaches chamber cleaning without the pedestal electrode being powered or biased. See column 4 – column 7, line 24.

Claims 51-54 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,164,330 (Davis).

Claims 7-12, 14 and 15, 51, 53 and 54 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,164,330, issued to Davis et al. (hereinafter, Davis).

Davis teaches a multi-step process for etching a multi-layered substrate. Davis' selection of etching gases is such that the etching residue is cleaned from the chamber surfaces. In a first step a layer is etched with a plasma generated from a mixture of Ar (serving as the claimed etchant) and NF_3 (serving as claimed cleaning gas). The second step of Davis is carried out with a plasma generated from gas mixtures such as (NF_3 / Cl_2 / Ar) or (SF_6 / Cl_2 / Ar), where the Cl_2 serves as the claimed second cleaning gas which is different from the first cleaning gas. Davis teaches that the second step could also include gases such as CF_4 and O_2 . See: column 2, lines 36-37; column 3, line 35 – column 4, line 7; column 8, line 18 – column 9, line 55.

Response to Arguments

Applicant's arguments filed December 17, 2001 have been fully considered but they are not persuasive.

Tatsumi:

Applicant argues that Tatsumi does not anticipate claim 7 (and claim 51) because Tatsumi fails to teach a method with a first stage in which a first etchant, that includes a fluorine containing cleaning gas, is used to etch the silicide layer while a second stage a second etchant is used to etch the polysilicon layer and then, in a third stage, provide a cleaning gas that is different from the cleaning gas used in the first

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stage. Applicant argues that Tatsumi does not teach etching through both the silicide layer and the polysilicon layer before introducing a second cleaning gas. Applicant argues that Tatsumi teaches etching only part way through the upper most metal silicide layer then applying the oxygen plasma and then completing the etch of the metal silicide and finally etching through the bottom polysilicon layer. What appears to be at issue is the timing of the Tatsumi's oxygen plasma treatment.

A fourth aspect of Tatsumi's invention interposes an oxygen plasma treatment between the step of etching the polycide layer (i.e. etching the combined silicide /polysilicon layer) and the step of over-etching. Over-etching, as described by Tatsumi, is a residue removal step that takes place after the polycide film has been etched to a depth substantially equal to its film thickness, that is after the polysilicon has been removed (see column 2, lines 41-57 and column 8, lines 3-22).

Therefore, the examiner notes that Tatsumi teaches a method with a first stage in which a first etchant, HBr, is mixed with SF₆, a fluorine containing cleaning gas. In the first stage this mixture is used to etch through the silicide layer. Upon reaching the silicide/polysilicon interface, Tatsumi teaches changing the composition of the etching gas (column 6, lines 35- 50). This would correspond to Applicant's claimed second stage. After etching the polysilicon layer Tatsumi teaches two additional steps. The first post-polysilicon etching step is an oxygen plasma treatment – in dependent claims Applicant claim oxygen as being the second cleaning gas. The second post-polysilicon etch is the over-etching. Therefore, Tatsumi teaches each limitation of the rejected claims.

Applicant argues that Tatsumi does not anticipate claim 19 because Tatsumi teaches creating an oxygen plasma with microwave energy rather than with the claimed RF energy.

The examiner points out that the microwave range of energy is a subset of the broader RF range. Therefore, in teaching the use of microwave energy Tatsumi is teaching the use of RF energy. Furthermore, the RF limitation pertains to the means by which the oxygen is excited into a plasma. As this represents an apparatus limitation it is given little weight in a method claim unless it can be shown to affect the process in a manipulative sense.

In re Tarczy-Hornoch 158 USPQ 141, 150 (CCPA 1968); *In re Edwards* 128 USPQ 387 (CCPA 1961); *Stalego v. Heymes* 120 USPQ 473, 478 (CCPA 1959); *Ex parte Hart* 117 USPQ 193 (PO BdPatApp 1957); *In re Freeman* 44 USPQ 116 (CCPA 1940); *In re Sweeney* 72 USPQ 501 CCPA 1947).

Cheung:

Applicant argues that Cheung does not anticipate claims 7, 19, 47 and 51 because Cheung fails to teach a third stage of providing a second energized cleaning gas after etching through the polysilicon layer.

The examiner calls Applicant's attention to column 9, lines 21-23 where Cheung does in fact teaches that which Applicant argues Cheung does not teach.

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Davis:

Applicant argues that Davis does not anticipate claim 51 because Davis "teaches etching through a single refractory metal layer in three steps" rather than providing a first and second etching gas to etch through a first and second layer respectively.

The examiner calls Applicant's attention to column 8, lines 38-50 where Davis does in fact teaches the etching of multiple layers, specifically, the etching of a W layer followed by the etching of an underlying Ti, TiW or TiN layer.

Allowable Subject Matter

Claims 1, 4-6, 27-36, 39 and 40 are allowed.

Claims 16, 45 and 50 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is (703) 306-9075. The examiner can normally be reached on Monday through Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski, can be reached on (703) 308-4333. The fax phone number for this Group is (703) 305-7719.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen, Ph.D.
April 8, 2002



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